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Technical Report

Sustainable Intensification of Key Farming Systems

in the Sudan and Guinea Savanna of West Africa

01 October 2012 to 31 March 2013

Submitted to

United States Agency for International Development (USAID)

The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government’s Feed the Future (FtF) initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation, and impact assessment.

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# **Summary**

# Implemented work and achievements for the period October 2012 to March 2013 are reported. Data collection from several field activities initiated during the first year of the project ended during the period. Data were analyzed and reports written. Results from analysis of 46 communities in Ghana and a household survey in Bougouni and Koutiala districts in Mali were published. Intervention communities in both Mali and Ghana were selected based on analysis of available socio-economic and biophysical data layers. Field trials identified improved cereal (maize, sorghum and millet), legume (soybean and cowpea) and vegetable varieties and agronomic management practices for intensive production. Quality seeds of cereals and legumes were produced for multiplication and dissemination to farmers and future project activities. Meetings of stakeholders, Project Steering Committee and Program Coordination Team meetings were organized during the period.

# **1. Introduction**

The U.S. Agency for International Development (USAID) is supporting multi-stakeholder agricultural research projects to sustainably intensify key African farming systems as part of the U.S. government’s ‘Feed the Future’ initiative to address global hunger and food security issues in sub-Saharan Africa (SSA). It is also a way of bringing regional focus to the CGIAR Research Programs (CRPs) on Integrated Systems, especially the CGIAR Research Programs on Dryland Systems (CRP 1.1) and Humid Tropics (CRP 1.2).

The International Institute of Tropical Agriculture (IITA) is the lead institute for developing and implementing the Sudan-Guinea Savanna zone project of Africa RISING. This project primarily focuses on maize/rice-legume-vegetable-livestock production systems in northern Ghana, and sorghum/millet-legume-vegetable-livestock based production systems in southern Mali, but is intended to result in spill-over effects to other similar agro-ecological zones. These two regions were chosen based on analysis of cropping systems, prevailing poverty, population levels, existing country development priorities, and the given potential for successfully improving agricultural productivity and livelihoods of the people.

The development of these regions will be based around research in best management practices for sustainable intensification (SI) of agricultural production. This requires well-coordinated efforts involving multiple donors, regional organizations, partner universities, the private sector, national and international agricultural research institutes, and non-government organizations (NGOs). The regional research approach will also provide the foundation for scaling up and scaling out technologies through broad partnerships and links to country-based Feed the Future programs.

Africa RISING is organized around 4 research outputs (RO) that are logically linked in time and space:

1: Situation Analysis and Program-wide Synthesis

2: Integrated Systems Improvement

3: Scaling and Delivery of Integrated Innovation

4: Integrated Monitoring and Evaluation

The Project started in October 2011 and is expected to be implemented over a total of five years.

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This report gives highlights of some activities implemented from October 2012 to March 2013. Most of these started during the previous reporting period and were now completed.

In Mali, project activities were implemented in Bougouni, Yanfolila, Kolondieba, Sikasso and Koutiala districts (Figure 1a), while in Ghana most activities occurred in the communities shown in Figure 1b.

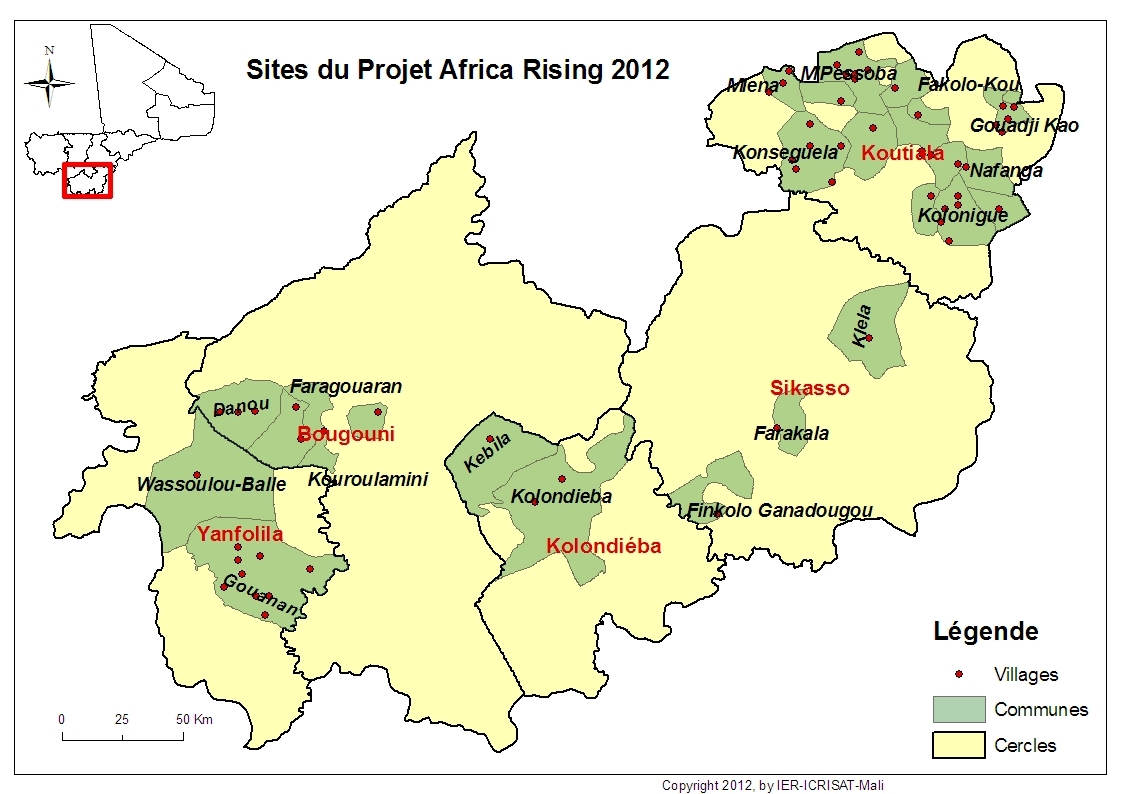


Figure1a. Sikasso region, showing the districts (in red text) and communes (black text) where Africa RISING activities were initiated. Red dots represent quick win action villages in 2012.

Figure 1b. Map of Upper East, Upper West and Northern Regions of Ghana with communities where activities were implemented.

# **2. Achievements during the reporting period**

**2.1 Research Output 1: Situation Analysis**

*2.1.1 Community analysis in Ghana published*

A [booklet](http://cgspace.cgiar.org/handle/10568/27937) was published on discussions with 48 communities and local leaders undertaken by multi-disciplinary facilitation teams in the Northern (NR), Upper West (UWR) and Upper East (UER) Regions of Ghana in May 2012. This first phase of a participatory research and extension process involved community engagement and social mobilization, supported by the communities’ own analysis of their existing situation. The community analysis showed that each region is dominated by cereal and legume cropping systems with livestock also providing an important source of food and cash (Table 1). Major crop production constraints include low and declining soil fertility; lack of improved seed; problems with pests, diseases and weeds, especially *Striga*; lack of draft power and equipment; and high costs of agricultural inputs (Table 2).

These problems are compounded by erratic rainfall and drought, floods and bush burning. Other constraints were lack of crop storage facilities; post-harvest pest and disease problems; lack of knowledge about processing with little or no processing equipment; low market prices; inadequate access roads; and poor transport facilities. With regards to livestock, community-raised problems included pests and diseases; poor access to veterinary services leading to high mortality rates; unavailability of improved breeds; and inadequate grazing and watering points in many areas.

Table 1. Ranking of cereals, legumes, and livestock across the three regions in northern Ghana

|  |  |  | Upper East | | |  |  |  | Upper West | | | | Northern | | | | | Overall ranking |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n | All | Food | | | Cash | | | n | All | Food | Cash | n | All | M | W | Y |
| M | W | Y | M | W | Y |
| **Cereals** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Maize | 46 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 19 | 1 | 1 | 1 | 27 | 1 | 1 | 1 | 1 | 1 |
| Sorghum | 46 | 2 | 4 | 3 | 4 | 2 | 3 | 5 | 19 | 2 | 2 | 2 | 22 | 3 | 3 | 3 | 3 | 2 |
| Rice | 46 | 4 | 5 | 5 | 3 | 3 | 2 | 2 | 19 | 3 | 3 | 3 | 22 | 2 | 2 | 1 | 2 | 3 |
| Early millet /millet | 46 | 2 | 1 | 1 | 1 | 4 | 5 | 3 | 19 | 4 | 4 | 4 | 12 | 4 | 4 | 4 | 4 | 4 |
| Late millet | 46 | 5 | 3 | 3 | 2 | 5 | 4 | 3 | - | - | - | - | - | - | - | - | - | 5 |
| **Legumes** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Groundnut | 46 | 2 | 1 | 1 | 3 | 2 | 2 | 2 | 19 | 1 | 1 | 1 | 27 | 1 | 1 | 1 | 1 | 1 |
| Cowpea | 46 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 19 | 2 | 2 | 2 | 22 | 3 | 2 | 3 | 3 | 2 |
| Soybean | 46 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 19 | 3 | 3 | 4 | 24 | 2 | 3 | 1 | 2 | 3 |
| Bambaranut | 46 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 17 | 4 | 4 | 3 | 16 | 4 | 4 | 4 | 4 | 4 |
| Kersting’s groundnut | - | - | - | - | - | - | - | - | 2 | 5 | 5 | 5 | - | - | - | - | - | - |
| Pigeon pea | - | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | - |
| **Livestock** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Poultry | 46 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | 19 | 3 | 2 | 3 | 25 | 1 | 1 | 1 | 1 | 1 |
| Goats | 46 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 19 | 2 | 1 | 2 | 25 | 2 | 3 | 3 | 2 | 2 |
| Sheep | 46 | 3 | 4 | 3 | 3 | 2 | 3 | 2 | 19 | 3 | 4 | 5 | 25 | 2 | 2 | 4 | 3 | 3 |
| Cattle | 41 | 5 | 5 | 6 | 5 | 5 | 6 | 1 | 16 | 3 | 3 | 1 | 18 | 5 | 4 | 2 | 5 | 4 |
| Pigs | 46 | 4 | 6 | 5 | 4 | 4 | 4 | 4 | 16 | 3 | 5 | 4 | 2 | 3 |  | 5 | 4 | 5 |
| Donkeys | 34 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 2 | 6 | 7 | 7 | - | - | - | - | - | - |
| Dogs | 23 | 5 | 2 | 4 | 6 | 6 | 5 | 5 | - | - | - | - | - | - | - | - | - | - |
| Rabbits | - | - | - | - | - | - | - | - | 4 | 6 | 1 | 1 | - | - | - | - | - | - |

n=Number of communities where crop or livestock were mentioned, M=Men, W=Women, Y=Youth

Table 2. Ranking of major production, processing and marketing constraints in each region in northern Ghana

| Constraints | Upper East | Upper West1 | Northern1 |
| --- | --- | --- | --- |
| **Crop** |  |  |  |
| Lack improved seeds/high cost | x | 1 | 2 |
| Low/declining soil fertility/high input cost | x | 2 | 2 |
| Pests, diseases and weeds/high input cost | x | 3 | 1 |
| Drought /unreliable / erratic / rainfall | x | 4 | 4 |
| Inadequate land prep/lack of equipment | x | 5 | 5 |
| *Striga* infestation | x | 6 | 6 |
| Lack of credit | x | 7 | 7 |
| Poor extension coverage | x | - | - |
| Flooding | x | - | - |
| Inadequate land | x | - | - |
| Livestock destruction of crops | x | - | - |
|  |  |  |  |
| **Processing and marketing** |  |  |  |
| Lack of storage facilities | - | x | x |
| Postharvest pest and disease losses | x | - | - |
| Lack of knowledge on processing | x | - | - |
| Lack of processing equipment | x | x | x |
| Lack of an organized market | - | x | x |
| Low produce price/ demand | x | x | x |
| Lack of transport | - | x | x |
| Exploitation by middlemen | x |  | - |
|  |  |  |  |
| **Livestock production** |  |  |  |
| Poor access to veterinary services | x | x | x |
| Diseases | x | x | x |
| PPR | x | - | - |
| Mange | x | - | x |
| Anthrax | x | - | - |
| Newcastle Disease | x | - | x |
| African swine fever | x | - | - |
| Worms and ticks | x | - | x |
| Diarrhoea/pneumonia | - | - | x |
| High mortality rates | x | x | x |
| Lack of improved breeds | x | - | - |
| Inadequate grazing | x | x | - |
| Inadequate watering points | x | x | - |

x=Problem identified but not ranked, 1Ranking of crop production problems (1=highest)

The major trend across the three regions is increasing maize and decreasing sorghum and millet production with generally static legume production, apart from soybean which is increasing in some areas. This is due to its low production cost and ready market providing an important income source, particularly for women. However, lack of soybean utilization knowledge and processing skills are limiting production in other areas. With regards to livestock, small ruminants and poultry production in particular are increasing in those areas where disease is not a major problem. A summary of the constraints and coping strategies is presented in Table 3.

Table 3. Constraints and some coping strategies

| Constraints | Coping strategies | Issues raised |
| --- | --- | --- |
| **Crop production** |  |  |
| Drought /unreliable / erratic / rainfall | * Plant early maturing and drought tolerant varieties * Conserve water by creating earth bunds | * Seed unavailability * High labor input required |
| Lack of improved seeds / high cost | * Local varieties are used in the absence of improved varieties | * Low cost, timely availability, but late maturity and low yields of local seed |
| Low/declining soil fertility/high input cost | * Application of manure and chemical fertilizers | * Manure available locally, but limited quantities * Unavailability and high cost of inorganic fertilizers * High cost of transport |
| Pests, diseases and weeds/high input cost | * Insecticide use to control insect pests especially on cowpeas * Herbicides to control weeds | * Unavailability and high cost * Hazard to people and livestock unless used safely * Lack of sprayers |
| Inadequate land preparation and lack of equipment | * Use of animal traction | * Can be used when no tractors available * Inadequate and late availability of animals often resulting in late planting |
| *Striga* infestation | * Intercropping of cereals with legumes to reduce *Striga* infestation * Use of crop rotations * Use of fertilizer * Hand weeding | * Does not always give adequate control |
| Poor extension coverage | * Farmer to farmer information sharing | * Inadequate farmer knowledge |
| Flooding | * Avoid flood prone areas * Dry season cropping | * Increasing need to use low lying areas due to population pressure |
| Bush burning and mining | * Community education for limiting mining operations | * Problem still persists |
|  | |  |
| **Processing and marketing** | |  |
| Lack of storage facilities  Postharvest pest and disease losses | * Use of PICS bags for cowpea storage | * High cost and availability |
| Lack of organized local markets | * Produce is taken to distant markets * Sale to middlemen | * High transport costs * Low prices * Exploitation by middle men |

Key interventions for the way forward were identified. These include the introduction of a number of improved sustainable land and livestock management practices supported with training not only in production, utilization and processing skills but also in leadership, marketing and communication skills to encourage farmer-to-farmer learning and extension. At the same time, advocacy to promote improved policies to reduce land degradation, improve market infrastructure and build partnerships are needed. These will require community and local leadership involvement in planning appropriate interventions; trying out new ideas through farmer experimentation; and, importantly, monitoring the process through lesson learning and experience sharing.

*2.1.2 Household survey in Mali*

Data from a household survey in Bougouni and Koutiala districts was analyzed and reported. Tables 4 and 5 present key results from the survey. Crop and livestock farming are the main sources of household income in Koutiala and Bougouni. Principal crops grown in the study sites are cotton, maize, sorghum, millet, groundnut and cowpea. Cotton is a commercial crop whereas the cereals are important for household food security. Livestock is important in the farming systems in both locations, especially for farm work, transport, and as a source of manure and revenue.

|  |  |  |
| --- | --- | --- |
| Table 4. Sources of income, input use and crop production by households in Koutiala and Bougouni, Mali | | |
|  | Koutiala | Bougouni |
| **Average crop production (kg per household interviewed)** |  |  |
| Millet | 2518 | 900 |
| Sorghum | 2458 | 1238 |
| Maize | 3051 | 4710 |
| Rice | 1000 | 1620 |
| Groundnut | 1015 | 2144 |
| Cowpea | 799 | 671 |
| Cotton | 4009 | 3710 |
|  |  |  |
| **Source of income (% of households interviewed)** |  |  |
| Sale of crop produce/products | 60 | 65 |
| Sale of live animals and products | 18 | 11 |
| Off-farm activities (commerce, remittances, salaried work) | 15 | 10 |
| Vegetable production | 5 | 2 |
| Forest products | 2 | 9 |
| Others (e.g. fishing) | 0 | 3 |
|  |  |  |
| **Agricultural input use (% of households interviewed)** |  |  |
| Inorganic fertilizer | 97 | 96 |
| Pesticides | 89 | 91 |
| Veterinary drugs/medicine | 86 | 94 |
| Improved seed | 63 | 75 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 5. Use of crops produced by the households in Koutiala and Bougouni, Mali (in % of total households interviewed) | | | | | | | | | |
|  | Household consumption | |  | Sale | |  | Gift | | |
|  | Koutiala | Bougouni |  | Koutiala | Bougouni |  | Koutiala | | Bougouni |
| Millet | 79 | 75 |  | 12 | 23 |  | 4 | | 2 |
| Maize | 76 | 72 |  | 16 | 22 |  | 5 | | 4 |
| Sorghum | 77 | 77 |  | 14 | 16 |  | 4 | | 3 |
| Rice | 75 | 60 |  | 20 | 29 |  | 4 | | 4 |
| Cotton | 9 | 0 |  | 91 | 100 |  | 0 | | 0 |
| Groundnut | 49 | 41 |  | 40 | 52 |  | 2 | | 3 |
| Cowpea | 84 | 55 |  | 16 | 40 |  | 2 | | 2 |
|  |  |  |  |  |  |  |  | |  |
| Sale of crop produce accounted for about 60% of the household income in both study sites. Sale of livestock (live animals) and products accounted for about 18% and 11% of household income in Koutiala and Bougouni respectively. Off-farm activities such as small scale commerce, remittances and salaried work accounted for about 15% and 10% of household income in Koutiala and Bougouni respectively. Forest products contributed significantly to household income in Bougouni. Major constraints to crop production are listed in Table 6.  Table 6. Major Constraints to crop production in Koutiala and Bougouni, Mali (in % of total households interviewed) | | | | | | | | | |
| Constraint | | | | | Koutiala | | | Bougouni | |
| Insufficient agricultural inputs | | | | | 24 | | | 26 | |
| Unfavorable climatic condition | | | | | 19 | | | 19 | |
| Soil degradation/fertility problem | | | | | 18 | | | 8 | |
| Inadequate agricultural tools and implements | | | | | 13 | | | 12 | |
| High cost of phytosanitary products | | | | | 4 | | | 7 | |
| Damage to crops by animals | | | | | 3 | | | 5 | |
| Long distance of farms from homesteads | | | | | 2 | | | 6 | |
| Household labor shortage | | | | | 5 | | | 3 | |
| Low commodity price | | | | | 2 | | | 4 | |
| Access to credit | | | | | 2 | | | 4 | |
| Lack of training & information | | | | | 4 | | | 3 | |
| Others (pest, transport, land availability) | | | | | 4 | | | 3 | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 7. Selected Action Communities in NR, UER, and UWR of Ghana (Community size: Small = 1-50; Medium = 51-100; and Large = > 100 hamlets) | | | | | | | |
| No | Domain/Region | Name | Hamlets | District | Size | Latitude | Longitude |
|  | **Northern region** |  |  |  |  |  |  |
| 1 | Salvelugu-Tolon | Manguli | 24 | Salve | Small | 9.47813 | -0.77973 |
| 2 | Salvelugu-Tolon | Tibali | 72 | Salve | Medium | 9.666837 | -0.84398 |
| 3 | Salvelugu-Tolon | Botingli | 29 | Salve | Small | 9.6117 | -0.78867 |
| 4 | Salvelugu-Tolon | Duko | 56 | Salve | Medium | 9.562964 | -0.83237 |
| 5 | Salvelugu-Tolon | Kpallung | 57 | Salve | Medium | 9.68450 | -0.78154 |
| 6 | Salvelugu-Tolon | Tiborgunayili | 101 | Tolon | Large | 9.4983929 | -1.2435746 |
| 7 | Salvelugu-Tolon | Tingoli | 152 | Tolon | Large | 9.3758738 | -1.0093572 |
| 8 | Salvelugu-Tolon | Cheyohi No 2 | 40 | Kumbu | Small | 9.4384688 | -0.9845980 |
| 9 | Salvelugu-Tolon | Kpirim | 22 | Tolon | Small | 9.5497741 | -1.0067476 |
| 10 | Salvelugu-Tolon | Gbanjon | 83 | Tolon | Medium | 9.4524979 | -1.1012374 |
|  |  |  |  |  |  |  |  |
|  | **Upper East** |  |  |  |  |  |  |
| 11 | Kassena-Bongo | Gia | 280 | Kassena | Large | 10.869269 | -1.122731 |
| 12 | Kassena-Bongo | Nyangua | 100 | Kassena | Medium | 10.935432 | -1.073623 |
| 13 | Kassena-Bongo | Tekuru | 100 | Kassena | Medium | 10.914777 | -1.049759 |
| 14 | Kassena-Bongo | Bonia | 244 | Kassena | Large | 10.87064 | -1.12764 |
| 15 | Kassena-Bongo | Sabulungo | 108 | Kassena | Large | 10.955178 | -0.859288 |
|  |  |  |  |  |  |  |  |
|  | **Upper West** |  |  |  |  |  |  |
| 16 | Wa West | Ole | 25 | WW | Small | 10.016431 | -2.613818 |
| 17 | Wa West | Zanko | 22 | WW | Small | 10.067212 | -2.595719 |
| 18 | Wa West | Pase | 45 | WW | Small | 10.037027 | -2.710677 |
| 19 | Wa West | Guo | 107 | WW | Large | 10.062071 | -2.608257 |
| 20 | Wa West | Siiriyin | 40 | WW | Small | 10.042371 | -2.593258 |
| 21 | Nadawli | Natodori | 286 | Nadaw | Large | 10.257167 | -2.626606 |
| 22 | Nadawli | Goli | 85 | Nadaw | Medium | 10.297161 | -2.631169 |
| 23 | Nadawli | Papu | 130 | Nadaw | Large | 10.235586 | -2.578928 |
| 24 | Nadawli | Gylli | 37 | Nadaw | Small | 10.202748 | -2.633025 |
| 25 | Nadawli | Goriyiri | 26 | Nadaw | Small | 10.345478 | -2.632489 |

*2.1.3 Vegetable production systems surveyed in Ghana*

AVRDC partnered with UDS to document existing vegetable varieties, to assess relative share of vegetables in the production landscape, and to estimate relative prevalence and performance of vegetables in northern Ghana. Thirty percent of the households surveyed grow vegetables as field crops for cash and household consumption. Most vegetables are produced under rain-fed agriculture either as sole or mixed crops with maize, millet and sorghum. The main vegetable crops are pepper (reported by 100% of households growing vegetables), followed by okra (96%), tomato (91%), amaranth (84%) and leafy cowpeas (62%). Leafy vegetables constitute 62% of the cultivated vegetables. Twenty-one percent of the households indicated that the area dedicated to vegetable production has increased over the past decade.

*2.1.4 Selection of interventions sites*

Most of the ‘quick win’ activities in year 1 were implemented at sites selected with little consideration of the socio-economic and biophysical factors and with minimal input from IFPRI, the lead institute, for site selection. An IFPRI-led selection of intervention communities using available biophysical and socio-economic data layers was therefore a major activity during the reporting period.

In Ghana, IFPRI reviewed available bio-physical (land cover, length of growing period, slope, rainfall, agro-ecological zones, elevation) and socio-economic (population density, market access) data layers for stratification, and identified domains (strata) based on the length of growing period (LGP) and market access in January 2013. A team of IITA and the Ministry of Food and Agriculture visited 61 potential intervention communities in the Upper East (12), Upper West (16) and Northern (33) Regions in February 2013. Twenty-five intervention communities were then selected based on local information about agricultural potential, accessibility during the rainy season, main cropping system, rain-fed versus irrigated rice farming, etc. (Table 7).

Selection for future intervention communities in Mali was conducted in January and February 2013. Initial stratification was based on annual rainfall (high for Bougouni-Yanfolila, low for Koutiala) and market access, which varied within each district. Action sites were chosen based on an original randomly selected list, with input from local partners. When an initially selected site did not meet these two criteria, local partners proposed a replacement site with similar market access and near to the initially selected site. The control sites selected are those sites from the initial random selection where the partner organizations did not intervene. These are associated with intervention sites according to their similarity in terms of population (based on data from 2005, the most current verified data available). When an initially selected site did not correspond to the action site according to these criteria, it was replaced by a nearby site that was a better fit. In some cases (particularly in Koutiala) sites were added based on priorities of local partner organizations. In the Bougouni-Yanfolila area, local partners were asked to assess the level of access to local markets outside of the main market town. These markets are the initial point of sale for most farmers and are often the administrative centers of communes (Table 8).

**2.2 Research Output 2: Integrated systems improvement**

Several field trials were initiated in 2012 to evaluate new and improved crop varieties (maize, sorghum, soybean, cowpea and vegetables) and best management practices with farmers in their own environment. The aim was to identify varieties and management practices which are appropriate to their needs, and to make quality seed of recently released varieties available for project activities in subsequent years. The activities were also to produce short-term outputs in 2012 and to support the longer term objectives of the Africa RISING project in West Africa. Most of the trials ended during the reporting period. Crops were harvested, data analyzed, and results written up. Highlights of some trials are presented below.

Table 8: Action sites in Sikasso Region, Mali

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| District | Commune | Village | Longitude | Latitude | Population (2005) | Recommended  control village | Access to  main market | Access to  a local market | Rainfall |
|
| **Action sites** |  |  |  |  |  |  |  |  |  |
| Bougouni | Faradiele | Flola | -7.63 | 11.42 | 404 | Yeni | H | H | H |
| Bougouni | Faragouaran | Sibirila | -7.76 | 11.44 | 767 | Siratogo | H | H | H |
| Bougouni | Kouroulamni | Madina | -7.67 | 11.38 | 1480 | Sakoro | H | H | H |
| Bougouni | Danou | Dieba | -7.91 | 11.52 | 1101 | Dossola | M | H | H |
| Yanfolila | Gouanan | Yorobougoula | -8 | 10.91 | 2175 | Dialakoro | M | H | H |
| Koutiala | Karangouana Malle | Karagouaran Malle | -5.76 | 12.57 | 2998 | Tiere | H |  | L |
| Koutiala | Songoua | Sirakele | -5.48 | 12.51 | 5555 | Konina | H |  | L |
| Koutiala | M'pessoba | M’pessoba | -5.71 | 12.68 | 9660 | Konseguela | H |  | L |
| Koutiala | Sincina | Nampossela | -5.34 | 12.33 | 2175 | Bobla-Zangasso | H |  | L |
| Koutiala | Fakolo | Zansoni | -5.57 | 12.61 | 3225 | N'Togonasso | M |  | L |

*2.2.1 Evaluation and dissemination of maize varieties and best practices to increase grain production*Responses of extra-early (80-85 days), early (85-100 days) and medium (100-110 days) maturing maize varieties to different nitrogen levels were evaluated in a multi-locational trial in the NR, UER and UWR of Ghana. A split-plot design with N fertilizer levels as main-plots and varieties as sub-plots with four replications was used in all locations.

There was no significant variety by N level interaction for any of the maturity types in any locations. In the UWR, the variety accounted for significant variation in plant height and grain yield of the extra early-maturing maize in Tumu and Wa, and nitrogen use efficiency in Wa (Table 9). For the early-maturing maize, varieties differed significantly in plant height, grain yield and nitrogen use efficiency at Tumu, but not at Wa (Table 10). The varieties differed significantly for plant height but not for grain yield or nitrogen use efficiency at Wa in the medium-maturing maize (Table 11). In NR, there were significant differences in plant height and grain yield among the extra-early and medium maturing maize varieties (Table 12). In all locations, plant height and grain yield increased; while nitrogen use efficiency declined with increasing N levels (Table 9, 10, 11 and 13).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 9. Responses of extra-early maturing maize varieties to nitrogen levels in on-station trials at Tumu and Wa, UWR, Ghana, 2012 | | | | | | | |
|  | Tumu |  |  |  | Wa |  |  |
|  | Height (cm) | Grain yield (kg/ha) | NUE (kg grain/kgN) |  | Plant height (cm) | Grain yield (kg/ha) | aNUE (kg grain/kg N) |
| **Variety** |  |  |  |  |  |  |  |
| 99 TZEE Y STR | 138 | 1250 | 16 |  | 155 | 2772 | 26 |
| TZEE W POP STR QPM C0 | 175 | 1496 | 14 |  | 198 | 3098 | 29 |
| 2000 Syn EE W STR | 146 | 1724 | 12 |  | 169 | 3096 | 29 |
| 2004 TZEE W POP STR C4 | 147 | 1662 | 19 |  | 197 | 3671 | 34 |
| Abontem | 161 | 1170 | 14 |  | 191 | 2864 | 24 |
| LSD (0.05) | 17 | 306 | ns |  | 13 | 507 | 7.7 |
|  |  |  |  |  |  |  |  |
| **N level (kg/ha)** |  |  |  |  |  |  |  |
| 0 | 127 | 397 |  |  | 1.61 | 1106 |  |
| 40 | 157 | 1262 | 21 |  | 1.76 | 2796 | 42 |
| 80 | 161 | 1721 | 17 |  | 1.82 | 3312 | 28 |
| 120 | 163 | 1893 | 13 |  | 1.90 | 3851 | 23 |
| 160 | 159 | 2030 | 10 |  | 2.01 | 4438 | 21 |
| N level- Linear | \*\* | \*\* | \*\* |  | \*\* | \*\* | \*\* |
| N level- Quadratic | \*\* | \*\* | ns |  | ns | \*\* | \* |
| aNUE = N use efficiency; ns = not significant; significant: \*P<0.05, \*\*P<0.01 | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 10. Responses of early-maturing maize varieties to nitrogen levels in on-station trials at Tumu and Wa, UWR, Ghana, 2012 | | | | | | | | | | | | | | | | | |
|  | Tumu | | |  | | |  | | |  | | Wa | | |  | |
|  | Plant height (cm) | | | Grain yield (kg/ha) | | | NUE (kg grain/kg N) | | |  | | Plant height (cm) | | | Grain yield (kg/ha) | |
| **Variety** |  | | |  | | |  | | |  | |  | | |  | |
| TZE W DT STR C4 | 138 | | | 2300 | | | 19 | | |  | | 154 | | | 2487 | |
| TZEComp3 DT C2F2 | 153 | | | 2196 | | | 17 | | |  | | 152 | | | 2307 | |
| Aburohemaa | 152 | | | 2222 | | | 16 | | |  | | 157 | | | 2587 | |
| Omankwa | 154 | | | 2296 | | | 21 | | |  | | 169 | | | 2572 | |
| Farmer variety | 187 | | | 1716 | | | 11 | | |  | | 166 | | | 2353 | |
| LSD (0.05) | 16 | | | 209 | | | 3.8 | | |  | | ns | | | ns | |
|  |  | | |  | | |  | | |  | |  | | |  | |
| **N level (kg/ha)** |  | | |  | | |  | | |  | |  | | |  | |
| 0 | 152 | | | 1017 | | |  | | |  | | 132 | | | 712 | |
| 40 | 150 | | | 2089 | | | 27 | | |  | | 153 | | | 2096 | |
| 80 | 156 | | | 2441 | | | 18 | | |  | | 155 | | | 2593 | |
| 120 | 163 | | | 2510 | | | 12 | | |  | | 178 | | | 3095 | |
| 160 | 1.63 | | | 2676 | | | 10 | | |  | | 180 | | | 3810 | |
| N level- Linear | \* | | | \*\* | | | \*\* | | |  | | \*\* | | | \*\* | |
| N level- Quadratic | ns | | | \*\* | | | \*\* | | |  | | ns | | | \* | |
| Table 11. Responses of medium-maturing on maize varieties to nitrogen levels in on-station trials at Wa, UWR, Ghana, 2012 | | | | | | | | | | | | | | | |
|  | Plant height (cm) | | | |  | Grain yield (kg/ha) | | | | |  | | aNUE (kg grain/kg N) | | |
| **Variety** |  | | | |  |  | | | | |  | |  | | |
| DT ST W COF2 | 163 | | | |  | 2851 | | | | |  | | 30 | | |
| DT SYN 1-W | 166 | | | |  | 2491 | | | | |  | | 25 | | |
| IWD C3SYN F2 | 147 | | | |  | 2305 | | | | |  | | 23 | | |
| Obatanpa | 181 | | | |  | 2936 | | | | |  | | 30 | | |
| Farmer’s variety | 173 | | | |  | 2698 | | | | |  | | 25 | | |
| LSD (0.05) | 12.1 | | | |  | ns | | | | |  | | 2.9 | | |
|  |  | | | |  |  | | | | |  | |  | | |
| **N level (kg/ha)** |  | | | |  |  | | | | |  | |  | | |
| 0 | 137 | | | |  | 773 | | | | |  | |  | | |
| 40 | 159 | | | |  | 2267 | | | | |  | | 373 | | |
| 80 | 174 | | | |  | 2811 | | | | |  | | 255 | | |
| 120 | 180 | | | |  | 3697 | | | | |  | | 244 | | |
| 160 | 181 | | | |  | 3732 | | | | |  | | 18.5 | | |
| N level- Linear | \*\* | | | |  | \*\* | | | | |  | | \*\* | | |
| N level- Quadratic | \*\* | | | |  | \*\* | | | | |  | | \*\* | | |
| CV% | 10.2 | | | |  | 14.9 | | | | |  | | 12.3 | | |
| aNUE = N use efficiency; ns = not significant; significant: \*P<0.05, \*\*P<0.01 | | | | | | | | | | | | | | | |
| Table 12. Plant height and grain yield of medium-maturing maize varieties across five nitrogen levels in on-station trials at Nyankpala, NR, Ghana, 2012 | | | | | | | | | | | | | | | |
| Variety | |  | Height (cm) | | | | |  | Grain yield (kg/ha) | | | | |
| 99 TZEE Y STR | |  | 129 | | | | |  | 1678 | | | | |
| TZEE W POP STR QPM C0 | |  | 147 | | | | |  | 2373 | | | | |
| 2000 Syn EE W STR | |  | 131 | | | | |  | 1897 | | | | |
| 2004 TZEE W POP STR C4 | |  | 129 | | | | |  | 2740 | | | | |
| Abontem | |  | 135 | | | | |  | 2308 | | | | |
| Mean | |  | 134 | | | | |  | 2199 | | | | |
| LSD (0.05) | |  | 15 | | | | |  | 483 | | | | |
|  | |  |  | | | | |  |  | | | | |
| TZE W DT STR C4 | |  | 163 | | | | |  | 2365 | | | | |
| TZEComp3 DT C2F2 | |  | 157 | | | | |  | 2469 | | | | |
| Aburohemaa | |  | 159 | | | | |  | 2379 | | | | |
| Omankwa | |  | 161 | | | | |  | 2491 | | | | |
| Farmer variety | |  | 163 | | | | |  | 2634 | | | | |
| Mean | |  | 161 | | | | |  | 2468 | | | | |
| LSD (0.05) | |  | ns | | | | |  | ns | | | | |
|  | |  |  | | | | |  |  | | | | |
| DT ST W COF2 | |  | 160 | | | | |  | 3779 | | | | |
| DT SYN 1-W | |  | 153 | | | | |  | 4109 | | | | |
| IWD C3SYN F2 | |  | 142 | | | | |  | 3388 | | | | |
| Obatanpa | |  | 166 | | | | |  | 4191 | | | | |
| Farmer’s variety | |  | 171 | | | | |  | 4285 | | | | |
| Mean | |  | 158 | | | | |  | 3950 | | | | |
| LSD (0.05) | |  | 10 | | | | |  | 813 | | | | |
|  | | | | | | | | | | | | | | | |

*2.2.2 Identifying appropriate cultivar, optimum spraying regime and planting date for intensive cowpea production*

Cowpea grain yields in farmers’ fields is below 500 kg/ha due to lack of improved cultivars, high incidence of diseases and pests, and inappropriate cultural practices. Applying insecticides can control pests and increase grain and fodder yields. However, few farmers use insecticides because it is costly and excessive use of insecticides can harm the environment. Two trials were conducted to develop integrated pest management for cowpea insect pest using host plant resistance in elite cultivars, appropriate planting date and reduced insecticide spraying regimes.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table 13. Responses of extra early-, early- and medium-maturing to nitrogen levels in on-station trials at Nyankpala, NR, Ghana, 2012 | | | | | |
| Type | Nitrogen level |  | Plant height (cm) |  | Grain yield (kg/ha) |
| **Extra-early** | 0 |  | 119 |  | 1199 |
|  | 40 |  | 134 |  | 2139 |
|  | 80 |  | 144 |  | 2727 |
|  | 120 |  | 134 |  | 2432 |
|  | 160 |  | 140 |  | 2502 |
|  | N-Linear |  | \* |  | \* |
|  | N-Quadratic |  | \* |  | \*\* |
|  |  |  |  |  |  |
| **Early** | 0 |  | 157 |  | 1563 |
|  | 40 |  | 165 |  | 2331 |
|  | 80 |  | 164 |  | 3014 |
|  | 120 |  | 163 |  | 2955 |
|  | 160 |  | 164 |  | 2976 |
|  | N-Linear |  | \*\* |  | \* |
|  | N-Quadratic |  | ns |  | \*\* |
|  |  |  |  |  |  |
| **Medium** | 0 |  | 142 |  | 2437 |
|  | 40 |  | 162 |  | 3175 |
|  | 80 |  | 164 |  | 4746 |
|  | 120 |  | 162 |  | 4783 |
|  | 160 |  | 161 |  | 4611 |
|  | N-Linear |  | \*\* |  |  |
|  | N-Quadratic |  | \* |  | \*\* |
|  | | | | | |

The first trial determined the effect of cowpea cultivar and spraying regime on the population of insect pests (thrips) and grain yield at two locations in the UER. No significant interaction was recorded between cowpea cultivar and spraying regime in either location.

The population of thrips at full flowering and grain yield were affected by cultivar and spraying regime (Table 14). Padi Tuya had the lowest grain yield at both locations, while Songotra produced the highest grain yield at Tansi; and Bawutawuta gave the highest grain yield at Googo. Spraying once and no spraying had similar effects on grain yield and thrips population (Table 14). Similarly, spraying either twice of thrice had similar effect on grain yield and thrips population. Average number of thrips and grain yield were relatively higher at Tansia than Googo.

The effect of spraying and planting date on pest infestation and grain yield of cowpea varieties was evaluated in a second trial. The results showed that spraying is essential for profitable cowpea production, with Songotra, Bawutawuta, IT99K-573-1-1 and IT99K-573-3-2-1 producing significantly higher grain yield than the farmers’ variety in the UER (Table 15). Planting cowpea between mid July and early August reduced thrips population and increased grain yield over planting from late-August onwards. The *Striga* resistant Songotra, IT99K-573-1-1 and IT99K-573-3-2-1 are the most preferred varieties for the region due to the heavy infestation of *Striga* seeds in most fields in the region.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 14. Cowpea cultivar and spraying regime effects on insect pest population and grain yield at Tansi and Googo, UER, Ghana, 2012 | | | | | | | | | | |
|  | Tansi | | | |  | | Googo | | | |
|  | Thripsd | | Grain (kg/ha) | |  | | Thrips | | Grain yield (kg/ha) | |
| **Cultivar** |  | |  | |  | |  | |  | |
| IT99K-573-1-1 | 20 | | 547 | |  | | 61 | | 721 | |
| IT99K-573-3-2-1 | 13 | | 484 | |  | | 64 | | 763 | |
| Songotra | 15 | | 607 | |  | | 55 | | 738 | |
| Padi Tuya | 13 | | 456 | |  | | 55 | | 520 | |
| Bawutawuta | 27 | | 573 | |  | | 51 | | 777 | |
| Farmers’ variety (control) | 21 | | 530 | |  | | 47 | | 775 | |
| Mean | 18 | | 533 | |  | | 56 | | 716 | |
| s.e.d | 6.5 | | 41.1 | |  | | 8.8 | | 55.3 | |
|  |  | |  | |  | |  | |  | |
| **Spraying regime** |  | |  | |  | |  | |  | |
| No spraying | 43 | | 241 | |  | | 91 | | 318 | |
| 1-Spraya | 17 | | 301 | |  | | 79 | | 364 | |
| 2-Spraysb | 7 | | 713 | |  | | 36 | | 1007 | |
| 3-Spraysc | 4 | | 867 | |  | | 17 | | 1173 | |
| Mean | 18 | | 531 | |  | | 56 | | 716 | |
| s.e.d | 9.4 | | 53.1 | |  | | 8.3 | | 55.8 | |
| aSpray once at 50% flowering;  bSpray twice at flower bud initiationand early podding | | | | | | | | | | |
| cSpray thrice at flower bud initiation, 50% flowering and 50% podding | | | | | | | | | | |
| dPopulation of thrips per 20 flowers sampled at full flowering  Table 15. Cowpea cultivar, planting date and spraying effects on number of thrips and grain yield in Googo in the UER, Ghana, 2012 | | | | | | | | | | |
|  | Thrips populationa | | | |  | | Grain yield (kg/ha) | | | |
|  | Spray | | No-spray | |  | | Spray | | No-spray | |
| **Cultivar** |  | |  | |  | |  | |  | |
| IT99K-573-1-1 | 74 | | 142 | |  | | 1123 | | 213 | |
| IT99K-573-3-2-1 | 74 | | 135 | |  | | 1105 | | 319 | |
| Songotra | 63 | | 110 | |  | | 1288 | | 196 | |
| Padi Tuya | 62 | | 111 | |  | | 916 | | 231 | |
| Bawutawuta | 49 | | 109 | |  | | 1092 | | 205 | |
| Farmers’ variety (control) | 70 | | 105 | |  | | 862 | | 176 | |
| Mean | 65 | | 119 | |  | | 1064 | | 223 | |
| s.e.d (cultivar x spray) | 11.4 | |  | |  | | 47.9 | |  | |
|  |  | |  | |  | |  | |  | |
| **Planting date** |  | |  | |  | |  | |  | |
| Mid-July | 42 | | 99 | |  | | 1124 | | 227 | |
| Late-July | 72 | | 97 | |  | | 1121 | | 224 | |
| Mid-August | 82 | | 160 | |  | | 984 | | 218 | |
| s.e.d | 12.6 | |  | |  | | 41.4 | |  | |
| aPopulation of thrips per 20 flowers sampled at full flowering  s.e.d. = standard error of difference | | | | | | | | | | |
| *2.2.3 Determining appropriate variety and best fertilization practices for intensive and profitable soybean production* The agronomic benefits of using N, phosphorus (P) and potassium (K) fertilizer and rhizobium inoculants for soybean production in the Guinea Savanna of Ghana was evaluated in a multi-locational trial at Wa in the UWR and Nyankpala and Yendi in NR. A split-plot design with soybean as main plots and fertilizer treatments as subplots were used. Five medium-maturing and three early-maturing soybean varieties were used in the first and second trials respectively.  Results showed no significant variety by fertilizer interaction for grain yield for either maturity type in either location. Variety significantly accounted for grain yield variation of the medium-maturing soybean varieties at Nyankpala, with varieties TGX-1448-2E and TGX-1904-E producing similar grain yield as Jenguma, the released variety. Variety differences for grain yield was not significant at Yendi or Wa (Table 16). | | | | | | | | | | |
|  | | | | | | | | | | |
| Table 16. Grain yield responses of medium maturing soybean varieties to fertilizer and rhizobium inoculation at Nyankpala and Yendi in the Northern and Wa in the UER, Ghana, 2012 | | | | | | | | | | | | |
|  | | | Nyankpala | |  | | Yendi | |  | | Wa | |
|  | | |  | |  | | (kg/ha) | |  | |  | |
| **Variety** | | |  | |  | |  | |  | |  | |
| TGX 1834-5E (Afayak) | | | 1500 | |  | | 1233 | |  | | 2589 | |
| TGX 1445-3E (Songda) | | | 1167 | |  | | 880 | |  | | 2419 | |
| TGX 1448-2E | | | 1993 | |  | | 1053 | |  | | 2704 | |
| TGX 1904-6F | | | 1967 | |  | | 1093 | |  | | 2678 | |
| Jengumaa | | | 1914 | |  | | 952 | |  | | 2789 | |
| Mean | | | 1708 | |  | | 1042 | |  | | 2636 | |
| LSD(0.05) | | | 389 | |  | | ns | |  | | ns | |
|  | | |  | |  | |  | |  | |  | |
| **Fertilizer treatmentb** | | |  | |  | |  | |  | |  | |
| No fertilizer | | | 1480 | |  | | 887 | |  | | 2333 | |
| Rhizobium inoculation (R) | | | 1620 | |  | | 1193 | |  | | 2437 | |
| P + K | | | 1615 | |  | | 1084 | |  | | 2844 | |
| N + P + K | | | 1906 | |  | | 881 | |  | | 2833 | |
| R + P + K | | | 1920 | |  | | 1167 | |  | | 2720 | |
| Mean | | |  | |  | |  | |  | |  | |
| LSD(0.05) | | | ns | |  | | 283 | |  | | 242 | |
| CV% | | | 35.0 | |  | | 42.9 | |  | | 12.4 | |
| aJenguma, released variety; bFertilizer: P = 60 kg P2O5/ha applied as triple superphosphate  K = potassium, 30 kg K2O/ha applied as muriate of potash; and N = 25 kg N/ha applied as urea;  ns = not significant | | | | | | | | | | | | |

Fertilizer treatment significantly affected grain yield at Yendi and Wa (Table 16). At Yendi, rhizobium inoculation resulted in significantly higher grain yield over the no fertilizer control. At Wa, a combination of NPK as well as P, K and inoculation resulted in significantly higher grain yield than inoculation alone or no fertilizer application.

For the early-maturing soybean varieties, grain yield of the released variety (Anidaso) was significantly higher than the other varieties (Table 17). Rhizobium inoculation as well as inoculation with P and K fertilizer application resulted in significantly higher grain yield than not applying fertilizer at all.

|  |  |  |  |
| --- | --- | --- | --- |
| Table 17. Grain yield and yield components responses of early-maturing soybean varieties to Rhizobium inoculation and fertilizer application, Bamahu, UWR, Ghana, 2012 | | | |
| Treatment | Days to flowering | Pods per plant | Grain yield (kg/ha) |
| **Variety** |  |  |  |
| TGX 1799-8F (Suong-Pungu) | 47 | 69 | 1752 |
| TGX 1805-8F | 50 | 74 | 1215 |
| Anidasoa | 40 | 71 | 2011 |
| LSD(0.05) | 1.0 | ns | 206 |
|  |  |  |  |
| **Fertilizer treatmentb** |  |  |  |
| No fertilizer | 50 | 61 | 1500 |
| Rhizobium inoculation (R) | 48 | 83 | 1778 |
| P + K | 49 | 68 | 1617 |
| N + P + K | 49 | 70 | 1574 |
| R +P + K | 49 | 74 | 1827 |
| LSD(0.05) | ns | ns | 266 |
| aAnidaso = released variety   |  | | --- | | bFertilizer: P = 60 kg P2O5/ha applied as triple superphosphate; K = potassium, 30 kg K2O/ha applied as muriate of potash; and N = 25 kg N/ha applied as urea;  ns = not significant | | | | |
|  | | | |

**2.3 Research Output 3: Scaling up and delivering agricultural technologies and innovations**

*2.3.1 On-farm demonstration of elite maize varieties*

Several on-farm demonstrations were held in Mali and Ghana to demonstrate improved varieties and management practices. Table 18 shows the performance of extra-early, early and medium maturity maize varieties in demonstration plots on farmers’ field in two districts in the UWR in Ghana. In both districts, some of the elite lines produced significantly more grain than the released varieties and the farmers’ varieties, indicating their potential for increased farm productivity. For example in Lawra district, the extra-early maturing line 2004 TZEE W POP STR C4 and 2004 TZEE W POP STR QPM CO out-yielded Abontem, the released variety.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 18. Grain yield of maize varieties in on-farm demonstrations in two districts, UWR, 2012 | | | | |
| District | Type | Location | Variety/line | Grain yield (kg/ha) |
| Lawra | Extra-early | 5 | 200 SYN EE W STR | 1053 |
|  |  |  | 2004 TZEE W POP STR C4 | 2770 |
|  |  |  | 99 TZEE Y STR | 1382 |
|  |  |  | 2004 TZEE W POP STR QPM C0 | 2300 |
|  |  |  | Abontema | 1247 |
|  |  |  | s.e. | 332.9\*\* |
|  | Early | 7 | TZE W DT STR C4 | 1493 |
|  |  |  | Farmer's variety | 1137 |
|  |  |  | Aburohemaaa | 1188 |
|  |  |  | s.e. | 111.1\* |
|  | Medium | 4 | DT SR W COF2 | 1188 |
|  |  |  | Farmer's variety | 1040 |
|  |  |  | Obatanpaa | 1000 |
|  |  |  | s.e. | 57.2ns |
| Nadowli | Extra- Early | 6 | 2000 SYN EE W STR | 2540 |
|  |  |  | 2004 TZEE W POP STR C4 | 1371 |
|  |  |  | 99 TZEE Y STR | 1941 |
|  |  |  | Abontema | 1591 |
|  |  |  | s.e. | 255.1\*\* |
|  | Early | 4 | TZE W DT STR C4 | 2216 |
|  |  |  | Farmer's variety | 1987 |
|  |  |  | Aburohemaaa | 2231 |
|  |  |  | s.e. | 79.1\* |
|  | Medium | 5 | DT SR W COF2 | 1503 |
|  |  |  | Framer's variety | 1833 |
|  |  |  | Obatanpaa | 1561 |
|  |  |  | s.e. | 101.6ns |

aReleased varieties; s.e. = standard error; ns = not significant; significant: \*P<0.05, \*\*P<0.01

*2.3.2 On-farm demonstration of elite vegetables*In Mali, high value vegetables were introduced, evaluated and promoted by AVRDC and partners. Field days were organized to document farmers’ preferences. Results from Koutiala showed differences in yield and farmer preferences for okra varieties (Table 19). Most farmers preferred the variety Batoumabe.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 19. On-farm yield and farmer preferences of okra varieties in Koutiala, Mali, 2012 | | | | | | | | | |
| Village |  | Okra variety yield (kg/ha) | | |  | Accessors | |  | Farmers’ |
|  |  | Batoumabe | Sasilon | Local |  | Men | Women |  | preference |
| Koutiala |  | 2875 | 1875 | 1562 |  | 45 | 15 |  | Batoumabe |
| Gantiesso |  | 3750 | 3125 | 1562 |  | 15 | 13 |  | Batoumabe |
| Kintieri |  | 4250 | 2812 | 2187 |  | 19 | 13 |  | Batoumabe |
| Nampossela |  | 3250 | 2812 | 2250 |  | 47 | 15 |  | Batoumabe |
| Sougoumba |  | 3437 | 2375 | 1875 |  | 30 | 15 |  | Batoumabe |
| Karangana |  | 1562 | 3000 | 1875 |  | 10 | 87 |  | Batoumabe |
| Farakala |  | 2500 | 3750 | 1875 |  | 12 | 38 |  | Batoumabe |
| Nangola |  | 2812 | 2187 | 2500 |  | 17 | 12 |  | Sasilon |
| Sirakele |  | 3437 | 2812 | 1875 |  | 5 | 12 |  | Batoumabe |

|  |  |  |  |
| --- | --- | --- | --- |
| Table 20. Breeder and certified seed produced in Ghana, 2012 | | | |
| Type | Crop | Variety | Seed produced (kg) |
| Breeder seed | Maize | Omankwa | 40 |
|  |  | Abrohemaa | 100 |
|  |  | Abontem | 120 |
|  |  | ***Total*** | ***260*** |
|  |  |  |  |
|  | Soybean | Jenguma | 600 |
|  |  | Quarshie | 800 |
|  |  | ***Total*** | ***1400*** |
|  |  |  |  |
|  | Cowpea | Songotra | 200 |
|  |  | Padi-Tuya | 300 |
|  |  | ***Total*** | ***900*** |
|  |  |  |  |
| Certified seed | Maize | Abontem | 3300 |
|  |  | Abrohemaa | 2880 |
|  |  | Omankwa | 720 |
|  |  | DTXR-WCoF2 | 4500 |
|  |  | ***Total*** | ***11400*** |
|  |  |  |  |
|  | Soybean | Jenguma | 3150 |
|  |  | TGX-1448-2E | 270 |
|  |  | TGX-1940-6F | 630 |
|  |  | ***Total*** | ***4050*** |
|  |  |  |  |
|  | Cowpea | Songotra | 270 |
|  |  | Padi-Tuya | 135 |
|  |  | Apagbuala | 180 |
|  |  | IT99K-573-1-1 | 267 |
|  |  | ***Total*** | ***852*** |

**3. Project meetings**

Between 23-25 October 2012 an [annual review and planning workshop](http://cgspace.cgiar.org/handle/10568/25113) was held in Tamale. This was followed by a proposal writing workshop on December. On January 23, 2013 [stakeholders](http://africa-rising.wikispaces.com/WA_StakeholderMeeting_Jan2013) were invited to Accra. The outcomes of year 1 and plans for year 2 were presented. This meeting was followed by the first [West Africa Project Steering Committee](http://africa-rising.wikispaces.com/WA_SC1) on 24 January and a [Program Coordination Team meeting](http://africa-rising.wikispaces.com/pct1) on 25 January. IITA and partners from Ghana met with IFPRI on 10-12 February in Accra to discuss the [baseline survey instrument](http://africa-rising.wikispaces.com/file/view/Ghana+Survey+Design+Workshop+Report_19Feb13.docx.docx/426153144/Ghana%20Survey%20Design%20Workshop%20Report_19Feb13.docx.docx). During the Program Coordination Team meeting, need was felt to discuss in depth the research methodologies used by each project and the scales at which research is conducted. Therefore, a [program level meeting](http://africa-rising.wikispaces.com/201303_Program_research_methodology_Malawi) was organized 6-8 March in Lilongwe, Malawi. Reports and notes from the meetings can be downloaded by following the indicated links.

**4. Project staff and office**

During the reporting period, the project has increased its staff. In addition to the exiting personnel, a project administrator and two technicians each for UER and UWR were hired.

The recruitment of additional project staff required more office space. Despite previous indications by the Savanna Agricultural Research Institute (SARI), who had been hosting the project office since April 2012 in Nyankpala near Tamale, no further rooms could be made available.

In addition, the poor internet connectivity in Nyankpala did not allow smooth project operations because it severely hampered communication with the Project Coordinator and partners. No viable mid-term solutions to the problem could be identified.

The project management therefore decided to rent a more spacious office building with good internet and telephone connectivity in Tamale town from 1 March 2013. The locale provides space for the project M&E expert to be recruited by IFPRI for West Africa, as well as project scientists who come for short business visits to Tamale.

**5. Project Partners**

The below list shows the partners who have been in collaboration under Africa RISING in West Africa during the reporting period.

|  |  |
| --- | --- |
|  |  |
| AMEDD | Association Malienne d’Eveil et de Developpement Durable, Mali |
| AMASSA | Afrique Verte, Mali |
| ARI | Animal Research Institute, Ghana |
| AVRDC | Asian Vegetable Research and Development Center, Mali |
| GHS | Ghana Health Services, Ghana |
| HSDC | Heritage Seed Company, Ghana |
| ICRAF | International Centre for Research in Agro Forestry, Mali |
| ICRISAT | International Crops Research Institute for the Semi Arid Tropics, Mali |
| IITA | International Institute of Tropical Agriculture, Ghana |
| ILRI | International Livestock Research Institute, Mali |
| MSF | Médecins Sans Frontières, Mali |
| MoFA | Ministry of Food and Agriculture, Ghana |
| MOBIOM | Mouvement Biologique du Mali, Mali |
| IWMI | International Water Management Institute, Ghana |
| SARI | Savanna Agricultural Research Institute, Ghana |
| SEEDPAG | Seed Producers Association of Ghana, Ghana |
| UDS | University for Developmental Studies, Ghana |
| WAID | Women in Agricultural Development, Ghana |

**6. Lessons and implementing issues**

In February 2013, AfricaRice decided to withdraw from both projects, in West Africa and Eastern/Southern Africa. The reason given was the incompatibility of Africa RISING M&E plans, implementation sites, research approach and reporting requirements with projects and procedures already in place at AfricaRice and agreed with their member countries. The interventions of the IITA Director General and Deputy Director General for Partnerships and Capacity Development could not prevent AfricaRice management from taking this decision. USAID informed IITA that discussions had taken place with AfricaRice but a way to overcome the basic differences could not be identified.

AfricaRice was a partner for research on rice-based systems in Ghana. However, the institute has no physical presence in the country. Therefore, during year 1, activities were commissioned to the rice research team at SARI. The same plans existed for this coming growing season. The withdrawal of AfricaRice will not have any negative impact on the project implementation. IITA will directly work with the SARI rice team. This new constellation will even accelerate the start of the activities and allow better follow-up of progress because of the presence of the IITA team in Tamale. It will also reduce transaction costs through directly contracting SARI.

The lesson to be learned from the AfricaRice decision is that new potential partners have to be carefully selected and undergo a process of checking suitability and comparative advantages if a true partnership is to be built and the involvement is not to add a burden on either side.

In Mali, project staff cannot move freely to the project sites because of the ongoing travel restrictions and security concerns. Some partner institutions have temporarily relocated their staff to neighboring countries. ILRI scientists are still not back in Mali. This situation has led to delays in project implementation, and also holds implications for the forthcoming growing season and field activities. ICRISAT does not allow international scientists to leave the capital. The project currently depends on local staff. The ban on fund transfer to government entities, especially to Institut d’Economie Rural (IER), limits the options of partnerships in Mali. The research team is therefore collaborating with NGOs. It is hoped that the security situation in the country will normalize after the planned elections in July and allow smooth project implementation. Should this not be the case, IITA and ICRISAT, together with the donor, should consider terminating the project in Mali. The suggestion of ICRISAT to re-locate the activities to Burkina Faso has not been received favorably by the donor. It would mean a complete new start at new sites, with the associated process of site selection and partner identification. Another option would be to intensify research activities on sorghum/millet based systems in northern Ghana. Already for the coming growing season, ICRISAT’s engagement will significantly grow in UER and UWR compared to year 1.

To date, IFPRI has not been successful in recruiting an M&E specialist to be based in West Africa. This had serious implications for the finalization of the site characterization and selection process, which could only be achieved in February/March. So far, no IFPRI scientist has visited Mali. Support to the process in Mali has been through remote guidance. In both countries, the baseline surveys have not yet been conducted and these are now scheduled for September/October this year. This means results will only be available six months later. There has been a lot of discussion between the research teams on the ground and IFPRI on the survey instrument. The IFPRI questionnaire has generally been considered impractical because it is too long and too detailed, with questions not relevant to agronomists. On the other hand, IFPRI has its own research interests which should be satisfied by baseline surveys. While for Ghana a compromise could be reached, that has not been the case in Mali.

IFPRI recently indicated that a promising candidate for the vacant position has been identified and the recruitment will be initiated.

**7. Selected publications**

Ellis-Jones J, Larbi A, Hoeschle-Zeledon I, Dugje I Y, Teli I A, Bauh S S J, Kanton R A L, Kombiok J M, Kamara A Y and Gyamfi I, 2012. Sustainable intensification of cereal-based farming systems in Ghana’s Guinea savannah: Constraints and opportunities identified with local communities. IITA Report. IITA, Ibadan, Nigeria. 22pp.

<http://cgspace.cgiar.org/handle/10568/27937>

AVRDC (The World Vegetable Center), 2013. Vegetables and associated best management practices in cereal-based production systems to improve income and diets of rural and urban households in northern Ghana and southern Mali, February 2013, 17 pp.  
<http://africa-rising.wikispaces.com/file/view/WA12_4.+Vegetables+systems.ppt/376705572/WA12_4.%20Vegetables%20systems.ppt>

SARI (Savanna Agricultural Research Institute), 2013. Annual report of Africa RISING project, February 2013, 66 pp. <http://cgspace.cgiar.org/bitstream/handle/10568/25201/ar_sari_ar2012.pdf?sequence=1>

IWMI (International Water Management Institute), 2013. Final technical report of Africa RISING project, February 2013, 22pp.

<http://africa-rising.wikispaces.com/file/view/Technical+Report+IWMI-IITA+%2801-05-12+to+30-11-12%29-1.doc/426050014/Technical%20Report%20IWMI-IITA%20%2801-05-12%20to%2030-11-12%29-1.doc>

ICRISAT (International Crops Research Institute for the Semi Arid Tropics, Mali), 2013. Africa RISING – West Africa (Mali). Technical report January-December 2012, January 2013, 32pp.   
<http://africa-rising.wikispaces.com/file/view/AfricaRISING-Mali-TechnicalReport+2012.pdf/406907414/AfricaRISING-Mali-TechnicalReport%202012.pdf>  
  
Maziya-Dixon, B. 2012. Desk study of nutritional and economic issues of Africa RISING target populations in Ghana. IITA, Ibadan, Nigeria, 12pp.  
<http://cgspace.cgiar.org/handle/10568/27937>